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PATENT FILING TRANSMITTAL

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# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Washington, D.C. 20231

Jc833 U.S. PTO  
09/592310  
06/13/00

## PATENT FILING TRANSMITTAL

Transmitted herewith for filing is the Patent Application of: Upendra V. Chaudhari, Stephane H. Maes, and Jiri Navratil

For: WEIGHT BASED BACKGROUND DISCRIMINANT FUNCTIONS  
IN AUTHENTICATION SYSTEMS

## TYPE OF FILING

This new patent application is for a(n):

- ☒ Utility
- ☐ Design
- ☐ Plant
- ☐ Divisional
- ☐ Continuation
- ☐ Continuation-in-part

## Benefit of a prior filed application

- ☐ This application claims the benefit of an earlier filed U.S. Patent Application under 35 USC 120.
- ☐ Please accord Applicant the benefit of the priority date of \_\_\_\_\_ to this case pursuant to 35 USC 119. Applicant's claim for priority is based on application \_\_\_\_\_ filed in \_\_\_\_\_ on that date.

## Filing under 37 CFR 1.53 (Utility) or 37 CFR 1.153 (Design)

- ☒ This is an application filed pursuant to 37 CFR 1.53 or 37 CFR 1.153, permitting receipt of a filing date upon filing of a specification, at least one claim and necessary drawings.
- ☒ In the event any parts of this application are incomplete, please treat this as a filing under 37 CFR 1.53 or 37 CFR 1.153.

## ENCLOSURES

- ☒ 15 - pages of written description;
- ☒ 8 - pages of claims;
- ☒ 1 - pages of abstract;
- ☐ \_\_\_\_\_ - sheets of formal drawings;
- ☒ 3 - sheets of informal drawings;
- ☒ Declaration and Power of Attorney or listing of inventors;
- and
- ☒ Two postcards for return to us as proof of receipt of the above documents.

plus

- ☐ An Assignment of the invention to IBM Corporation and an Assignment cover sheet;
- ☐ Verified Statement Claiming Small Entity Status (37 CFR 1.9(f) and 1.27(b))

- ☐ Form PTO-1449 (IDS) and two copies of the references listed thereon;
- ☐ A certified copy of \_\_\_\_\_ (country) patent application number (priority document).
- ☐ A preliminary amendment;
- ☐ Declaration of Biological Deposit;
- ☐ Submission of sequence listing, computer readable copy and/or amendment relating thereto for biotechnology invention containing nucleotide and/or amino acid sequence;
- ☐ An associate power of attorney;
- ☐ Other.

### DECLARATION OR OATH

The enclosed Declaration or Oath has been executed by:

- ☐ Inventor(s);
- ☐ Legal representative of the inventors (37 CFR 1.42 or 1.43);
- ☐ Joint inventor or person showing proprietary interest on behalf of an inventor who refused to sign or who cannot be reached and this is a petition required by 37 CFR 1.47 and the statement required by 37 CFR 1.47 is attached;
- ☒ Has not been executed and is enclosed for the purposes of identifying the inventors.

### INVENTORSHIP STATEMENT

The inventorship for all the claims in this application is:

- ☐ the same;
- ☐ not the same and, as an explanation, a statement is/ will be submitted.

### LANGUAGE

The application submitted herewith is:

- ☒ in English;
- ☐ in not in English and in terms of 37 CFR 1.52(d) a verified translation is
  - ☐ attached
  - ☐ not attached.

### FEE CALCULATION

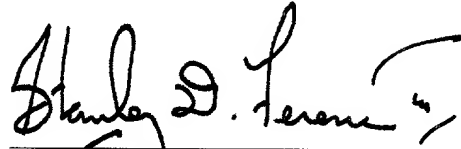
The filing fee has been calculated as shown below:

			SMALL ENTITY OR	OTHER THAN A SMALL ENTITY
BASIC FEE Design Patent	\$155	\$	\$310	\$
BASIC FEE Utility Patent	\$345	\$	\$690	\$690
EXTRA FEES	RATE	FEE	RATE	FEE
TOTAL CLAIMS 19 MINUS 20= 0	x 9=	\$0	x18=	\$0
INDEP. CLAIMS 5 MINUS 3 = 0	x 39=	\$0	x78=	\$156
<input type="checkbox"/> MULTIPLE DEP. CLAIM	+135=	\$	+270=	\$
<input type="checkbox"/> ASSIGNMENT	+ 40=	\$	+40=	\$
<input type="checkbox"/> RULE 53 SURCHARGE	+ 65=	\$	+130=	\$
TOTAL		\$		\$846

**FEE PAYMENT**

☐ Attached is Check No. \_\_\_\_\_ in the sum of \$ \_\_\_\_\_ to cover the filing fee and, if applicable, the assignment fee.

Respectfully submitted,



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PATENT

Docket No. YOR9-2000-0167US1

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant(s) : Upendra V. Chaudhari et al      Group Art: not yet assigned  
Serial No. : not yet assigned      Examiner: not yet assigned  
Filed : herewith  
For : WEIGHT BASED BACKGROUND DISCRIMINANT FUNCTIONS  
IN AUTHENTICATION SYSTEMS



**EXPRESS MAIL CERTIFICATE**

Express Mail Label No. EL503717275US

Date of Deposit 13 June 2000

I hereby certify that the following attached paper(s) or fee:

Patent Application  
Written Description  
Claims 1-19  
Abstract  
Drawings (Figs. 1-4)  
Declaration and Power of Attorney (unexecuted)  
Patent Filing Transmittal  
Certificate of Express Mail  
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are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service  
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Patents, Washington, D.C. 20231.

Stanley D. Ference III

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person mailing paper)

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## **WEIGHT BASED BACKGROUND DISCRIMINANT**

### **FUNCTIONS IN AUTHENTICATION SYSTEMS**

#### **Field of the Invention**

The present invention generally relates to identification, such as voice-based  
5 authentication, of an individual's identity.

#### **Background of the Invention**

When authenticating an individual's identity via an individual's voice, a general  
objective is to decide, when given an identity claim (e.g. a name), whether the speech data  
of the user making the claim matches the voiceprint (data model) of the claimant (target)  
10 better than data models of the background population. To support this capability, the  
claimant must be enrolled in the system. Some possible applications for voice  
authentication, among others, are for verification purposes for gaining access to a locked  
door, access to an automatic teller machine, or generally for obviating the use of physical  
keys or passwords (though it should be noted that keys or passwords may still be used in  
15 conjunction with the methods described herein) or for enrolling a voice in a database in  
similar contexts. An example of conventional voice authentication is described in  
"Conversational Biometrics" (S.H. Maes, EUROSPEECH99).

Normally, speech data is collected by the data collection agent which performs the necessary data analysis and passes the resulting feature set to the modeling or testing agents depending on whether the desired operation is enrollment or verification. (See Figure 1). However, previous efforts have generally failed to undertake voice-based authentication in a manner that provides the degree of accuracy and effectiveness often sought.

Thus, a need has been recognized in connection with providing an improved approach to such voice-based authentication.

### **Summary of the Invention**

In accordance with at least one presently preferred embodiment of the present invention, authentication is carried out as a two-class hypothesis test. The two classes are “target” and “background”, the former referring to data and/or characteristics relating to a speaker whose voice is to be authenticated and the latter referring to data and/or characteristics relating to at least one other speaker against which the “target” data and/or characteristics may be compared. The present invention broadly contemplates, in accordance with at least one presently preferred embodiment, using more than one background model in determining the background discriminant, whereas previous efforts have typically focused on using only one background model.

Other aspects and refinements of the present invention, in accordance with at least one presently preferred embodiment, will become apparent from the detailed discussion further below.

In one aspect, the present invention provides a method of providing authentication,  
5 the method comprising the steps of: receiving an identity claim; determining a target discriminant based on the identity claim and on at least one target model relating to a target individual; determining a background discriminant based on the identity claim and on at least one background model relating to at least one background individual;  
determining a score based on the target discriminant and the background discriminant; and  
10 accepting or rejecting the identity claim based on the determined score.

In another aspect, the present invention provides a method of providing speech-based authentication, the method comprising the steps of: receiving an identity claim; determining a target discriminant based on the identity claim and on at least one target voiceprint model relating to a target speaker; determining a background discriminant  
15 based on the identity claim and on at least one background voiceprint model relating to at least one background speaker; determining a score based on the target discriminant and the background discriminant; and accepting or rejecting the identity claim based on the determined score.

In a further aspect, the present invention provides an apparatus for providing authentication, the apparatus comprising: a receiving arrangement which receives an identity claim; a target discriminant generator which determines a target discriminant based on the identity claim and on at least one target model relating to a target individual;  
5 a background discriminant generator which determines a background discriminant based on the identity claim and on at least one background model relating to at least one background individual; and a decision arrangement which determines a score based on the target discriminant and the background discriminant, and accepts or rejects the identity claim based on the determined score.

10 In an additional aspect, the present invention provides, an apparatus for providing speech-based authentication, the apparatus comprising: a receiving arrangement which receives an identity claim; a target discriminant generator which determines a target discriminant based on the identity claim and on at least one target voiceprint model relating to a target speaker; a background discriminant generator which determines a  
15 background discriminant based on the identity claim and on at least one background voiceprint model relating to at least one background speaker; and a decision arrangement which determines a score based on the target discriminant and the background discriminant, and accepts or rejects the identity claim based on the determined score.



Furthermore, the present invention provides in another aspect a program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform method steps for providing authentication, the method comprising the steps of: receiving an identity claim; determining a target discriminant based on the identity claim and on at least one target model relating to a target individual; determining a background discriminant based on the identity claim and on at least one background model relating to at least one background individual; determining a score based on the target discriminant and the background discriminant; and accepting or rejecting the identity claim based on the determined score.

For a better understanding of the present invention, together with other and further features and advantages thereof, reference is made to the following description, taken in conjunction with the accompanying drawings, and the scope of the invention will be pointed out in the appended claims.

#### **Brief Description of the Drawings**

Figure 1 schematically illustrates initial data processing in an authentication system.

Figure 2 is a block diagram of a verification process in authentication.

Figure 3 is a block diagram of an enrollment process in authentication.

Figure 4 illustrates various weight vectors that may be utilized.

### **Description of the Preferred Embodiments**

Figure 1 generally illustrates an authentication system and its characteristic  
5 components. Speech data 102 is preferably collected by a data collection agent 104,  
which itself includes arrangements for frame extraction (106) and processing (108). The  
feature vectors that result (110) are then processed further, either for verification (112) or  
enrollment (114). Enrollment is the process by which the statistical properties of a given  
target's training speech data are gathered and modeled. The particulars of enrollment are  
10 well-documented and can be found, for example, in the copending and commonly assigned  
U.S. patent application entitled "Speaker Recognition Method Based on Structured  
Speaker Modeling and a 'Pickmax' Scoring Technique" (U. Chaudhari et al.), filed  
herewith.

As stated above, in accordance with at least one presently preferred embodiment  
15 of the present invention, authentication is preferably carried out as a two-class (target and  
background) hypothesis test. Input for rendering a final decision (on the authenticity of  
an identity claim) is preferably in the form of a real-valued function assigned to each class

(a “discriminant”), along with processed speech data. The contemplated technique will preferably be independent of the particular processing used. Figure 2, thus, shows a block diagram illustrating a verification process while Figure 3 illustrates a contemplated enrollment process.

5            Preferably, for both the target discriminant and the background discriminant, higher values will indicate better matches of the test speech with respect to the voiceprint and background population models being compared against. In at least one embodiment of the present invention, both of the (target and background) discriminant functions depend on the claimed identity. In addition, the background class discriminant may  
10        depend on an automatically generated background profile.

             As shown in Figure 2 (*i.e.*, the “verification” block diagram), speech data 202 may preferably be input into a data collection agent 204 per usual. From this, however, the hypothesis test preferably proceeds in two classes such that a target discriminant is calculated at 222 while a background discriminant is calculated at 226. As input for  
15        determining the target discriminant at 222, the identity claim being made (at 216, *e.g.*, in the form of an individual uttering a name, or via essentially any other mechanism to provide an identity claim [*e.g.*, an ID keyed on a phone or ATM, or passed on by the rest

of the business logic in question]) is used to extract from voiceprint models 218 the corresponding voiceprint 220.

In contrast to previous efforts, however, it is not the case that just one global voiceprint is assigned to the background. Rather, the discriminant for the background  
5 class is preferably a target-dependent function of individual voiceprint-based discriminants in the background population, which individual discriminants are inherent in background population models 224. Thus, several background population models 224 preferably assist in serving as input into the background discriminant function, as well as weights (inherent in a background profile 225) that will be appreciated from the equations  
10 herebelow. Because the presently contemplated embodiment is based on speech (as opposed to, for instance, fingerprints or facial characteristics), the data models used (218, 224) are chosen to capture a speaker's characteristics. Thus, the presently contemplated embodiment relates to speaker recognition. In this case, the "biometrics" are voice prints that characterize or model the voice of speakers. When other bioemtrics are used, it will  
15 be understood that the models of the users are to be chosen to characterize the corresponding biometric. The speech-related method described here can thus be extended to other biometrics.

In accordance with at least one presently preferred embodiment of the present invention, use is made of a sequence of Mel-frequency cepstral vectors  $\{\mathbf{x}_i\}$  in  $R^n$  as the basic representation of training and testing data. To this, delta-cepstra parameters are preferably added, which have proven to be effective in the text-independent setting. In order to mitigate the effects of channel interference, cepstral mean subtraction is preferably used. Further, the voiceprint models  $\mathbf{M}_{j,\{T\}}^j$  are preferably denoted by  $\{\mathbf{T}_k^j \mathbf{m}_{k,i}, \mathbf{T}_k^j \Sigma_{k,i} \mathbf{T}_k^{j\,t}, \mathbf{p}_{k,i}\}$ . This model is a set of Gaussian mixture models with  $k$  indicating the mixture and  $i$  indicating the component in the mixture. The specific form of this model can be found in U. Chaudhari et al., *supra*.

In accordance with at least one embodiment of the present invention, enrollment (Figure 3) preferably involves constructing a voiceprint for the target (330) along with an associated target dependent background profile 325 which adapts the background population to the target. Background profile 325 is preferably constructed by assigning a number to the relative importance of every background model based on its similarity to the target. The specific method used in connection with speech is described in detail later.

The target discriminant function will preferably be given directly by the voiceprint 330, while the background profile will be used subsequently to construct a target dependent background discriminant function.

Some more detailed aspects of at least one embodiment of the present invention will now be discussed, with reference being made to both Figures 2 and 3 simultaneously unless otherwise noted.

Given a set of vectors  $\mathbf{X}$  in  $R^n$ , the likelihood based discriminant function for any individual target (or background) model (222, 226) is preferably:

$$D(\mathbf{X}|\mathbf{M}_{\{T\}}^j) = \sum_{\mathbf{x} \in \mathbf{X}} \max_k \log[\max_i \mathbf{p}_{k,i}^j \mathbf{p}(\mathbf{T}_{k\mathbf{x}}^j | \mathbf{T}_k^j \mathbf{m}_{k,i}^j, \mathbf{T}_k^j \Sigma_{k,i}^j \mathbf{T}_k^j)]$$

The form of this function is a subject of the aforementioned patent application (U. Chaudhari et al.) and serves here as an example. However, any other suitable discriminant functions may be used at this point.

Preferably, the first step in constructing the background functions 226 is to individually model the enrollment data of each background speaker with a voiceprint. This is inherent in the "background population models" indicated at 224 (*i.e.*, before any target is enrolled, each background speaker is enrolled according to the target discriminant path through 222, and then all of the background models are then stored in 224). Thus, contemplated herein is a set of procedures to generate a variety of discriminant functions for a background reference population. One may be termed the *Enforced* (or adjustable) method, the purpose of which is to guarantee consistent behavior and performance over all

of the target speaker population. The other may be termed the *Automatic* (or adaptive) method, which determines (possibly dynamically) the function based on the set of background discriminant scores.

As to the background discriminant function, let  $\mathbf{M}_{BG}$  denote the set of voiceprints.

- 5 Without loss of generality, let there be  $N_{BG}$  background models and let  $\mathbf{M}_{BG}$  be a vector of all of the individual background model discriminant functions arranged in some order.

Note that these functions are the same as the target function described above.

- The background discriminant is defined by  $\mathbf{M}_{BG}$  together with a  $N_{BG} \times N_{BG}$  permutation matrix  $\mathbf{P}^j$  and a  $N_{BG} \times 1$  weight vector  $\mathbf{W}^j$ . The superscript indicates that these  
10 last two are target dependent.  $\mathbf{P}^j$  and  $\mathbf{W}^j$  constitute the background profile mentioned earlier.  $\mathbf{W}^j$  alone may also be referred to as the profile or weight profile. In this case  $\mathbf{P}^j$  will be given with the identity matrix.

Given test data for target  $j$  (i.e. the identity claim  $j$  along with validation data) the background model discriminant function score is preferably defined as

15 
$$\mathbf{M}_{BG} \mathbf{P}^j \mathbf{W}^j(\mathbf{X}). \quad (1)$$

Recall that  $\mathbf{M}_{BG}$  is a vector valued function of  $\mathbf{X}$ . Thus equation 1 is a scalar valued equation.

As to the *Enforced* method, the specification of  $\mathbf{P}^j$  and  $\mathbf{W}^j$  permits the meaning of the profile to be assigned and varied. As a non-restrictive example, one may consider the following. Let  $\mathbf{P}^j$  be defined so that  $\mathbf{M}_{\text{BG}}\mathbf{P}^j$  is sorted such that in the resulting vector, the background discriminant function in the first position is the one with the highest value on the training data,  $\mathbf{X}_j$ , for target speaker  $j$ . The corresponding values will decrease monotonically to the end of the vector. Next one may consider the weight graphs shown in Figure 4. Selecting one of these allows us to define background discriminant functions with specific properties with respect to a given target model. For example, using the "Middle Background" profile allows one to compare essentially any target to models which represent the "average" population with respect to the target (i.e. speakers that are not too close or too far), thus allowing the technique to better match the training data. If the weighting were static (with respect to target variation), such a claim could not be made. Similar effects can be created by using the other profiles shown, or for that matter, any other profile. The important point is that the same behavior across all targets can be guaranteed.

The background profile 225/325 may also be determined automatically from the background discriminant values. In this case,  $\mathbf{P}^j$  may be set to be the identity matrix. As one example, by normalizing (i.e. creating a probability mass function out of) the vector  $\mathbf{M}_{\text{BG}}\mathbf{P}^j(\mathbf{X}_j)$ , where  $\mathbf{X}_j$  is the training data for target speaker  $j$ , and then using it as  $\mathbf{W}^j$ , one



can create a similar effect to a "Near Background" profile such as that illustrated in Figure

4. In addition, one may make modifications to the procedure in order to temper the sensitivity to extremes in the set of background discriminant values with respect to their effect on the automatic weight computation, thus allowing the technique to better match the text conditions. One may, for example, ignore the highest and/or lowest scoring background models in order to increase robustness.

In the above methods, one may replace the training data for speaker  $j$ ,  $\mathbf{X}_j$ , with the test data for a particular claim,  $\mathbf{X}_{\text{test}}$ . In this way, the  $\mathbf{P}^j$  matrix is calculated independently for each verification test. There is no effect on the weights unless the latter automatic technique is used.

It will be appreciated that contemplated herein are methods for creating an adaptive and stable background *population* discriminant function using individual discriminants in the population via the use of *Enforced* (adjustable) and *Automatic* (adaptive) methods for generating weighting (or background) profiles to be used in the construction procedure. These techniques help improve system robustness in a number of ways but, particularly, the ability to specify weighting profiles allows one to focus on a consistent background characteristic for all target speakers enrolled. This is accomplished by the combined use of  $\mathbf{P}^j$  and  $\mathbf{W}^j$ . As the target and background population may contain

data from a variety of environments, the adaptive and target specific nature of the profile provides a form of environment normalization.

It is to be understood that the present invention, in accordance with at least one presently preferred embodiment, includes a receiving arrangement which receives an  
5 identity claim, a target discriminant generator which determines a target discriminant, a background discriminant generator which determines a background discriminant and a decision arrangement which determines a score based on the target discriminant and the background discriminant, and accepts or rejects the identity claim based on the determined score. Together, the receiving arrangement, target discriminant generator, background  
10 discriminant generator, and decision arrangement may be implemented on at least one general-purpose computer running suitable software programs. These may also be implemented on at least one Integrated Circuit or part of at least one Integrated Circuit. Thus, it is to be understood that the invention may be implemented in hardware, software, or a combination of both.

15 If not otherwise stated herein, it is to be assumed that all patents, patent applications, patent publications and other publications (including web-based publications) mentioned and cited herein are hereby fully incorporated by reference herein as if set forth in their entirety herein.

Although illustrative embodiments of the present invention have been described herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to those precise embodiments, and that various other changes and modifications may be affected therein by one skilled in the art without departing from the scope or spirit of the invention.

## Claims

What is claimed is:

1. A method of providing authentication, said method comprising the steps of:

receiving an identity claim;

5 determining a target discriminant based on the identity claim and on at least one target model relating to a target individual;

determining a background discriminant based on the identity claim and on at least one background model relating to at least one background individual;

determining a score based on the target discriminant and the background  
10 discriminant; and

accepting or rejecting the identity claim based on the determined score.

2. The method according to Claim 1, wherein said step of determining the background discriminant comprises providing a background profile and further determining the background discriminant based on the background profile.

3. The method according to Claim 1, wherein said step of providing a background profile comprises:

determining a permutation matrix;

determining a weight vector; and

5 determining the background profile based on the permutation matrix and the weight vector.

4. The method according to Claim 3, wherein said step of determining the weight vector comprises selecting a weight graph that relates the individual background discriminant functions to at least one characteristic associated with the at least one target  
10 voiceprint model.

5. The method according to Claim 3, wherein said step of providing the background profile comprises providing the background profile automatically.

6. The method according to Claim 5, wherein said step of determining the permutation matrix comprises providing the permutation matrix as the identity matrix.

15 7. The method according to Claim 1, further comprising:

providing a plurality of background population models; and

ascertaining individual discriminants in correspondence with each of the  
background population models;

said step of determining the background discriminant comprising determining the  
5 background discriminant as a function of the individual discriminants.

8. The method according to Claim 7, wherein said step of determining the  
background discriminant comprises determining the background discriminant as a  
function, of the individual discriminants corresponding to each of the background  
population models, that is dependent on at least one characteristic relating to the target  
10 individual.

9. A method of providing speech-based authentication, said method comprising  
the steps of:

receiving an identity claim;

determining a target discriminant based on the identity claim and on at least one  
15 target voiceprint model relating to a target speaker;

determining a background discriminant based on the identity claim and on at least one background voiceprint model relating to at least one background speaker;

determining a score based on the target discriminant and the background discriminant; and

5 accepting or rejecting the identity claim based on the determined score.

10. An apparatus for providing authentication, said apparatus comprising:

a receiving arrangement which receives an identity claim;

a target discriminant generator which determines a target discriminant based on the identity claim and on at least one target model relating to a target individual;

10 a background discriminant generator which determines a background discriminant based on the identity claim and on at least one background model relating to at least one background individual; and

a decision arrangement which determines a score based on the target discriminant and the background discriminant, and accepts or rejects the identity claim based on the  
15 determined score.

11. The apparatus according to Claim 10, wherein said background discriminant generator is adapted to provide a background profile and further to determine the background discriminant based on the background profile.

12. The apparatus according to Claim 10, wherein said background discriminant generator is further adapted to:

determine a permutation matrix;

determine a weight vector; and

determine the background profile based on the permutation matrix and the weight vector.

13. The apparatus according to Claim 12, wherein said background discriminant generator is adapted to determine the weight vector via selecting a weight graph that relates the individual background discriminant functions to at least one characteristic associated with the at least one target model.

14. The apparatus according to Claim 12, wherein said background discriminant generator is adapted to provide the background profile automatically.



15. The apparatus according to Claim 14, wherein said background discriminant generator is adapted to provide the permutation matrix as the identity matrix.

16. The apparatus according to Claim 10, wherein:

the at least one background population voiceprint model comprises a plurality of  
5 background population models; and

said background discriminant generator is adapted to:

ascertain individual discriminants in correspondence with each of the  
background population models; and

determine the background discriminant as a function of the individual  
10 discriminants.

17. The apparatus according to Claim 16, wherein said background discriminant generator is further adapted to determine the background discriminant as a function, of the individual discriminants corresponding to each of the background population models, that is dependent on at least one characteristic relating to the target speaker.

15 18. An apparatus for providing speech-based authentication, said apparatus comprising:

a receiving arrangement which receives an identity claim;

a target discriminant generator which determines a target discriminant based on the identity claim and on at least one target voiceprint model relating to a target speaker;

a background discriminant generator which determines a background discriminant  
5 based on the identity claim and on at least one background voiceprint model relating to at least one background speaker; and

a decision arrangement which determines a score based on the target discriminant and the background discriminant, and accepts or rejects the identity claim based on the determined score.

10 19. A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform method steps for providing authentication, said method comprising the steps of:

receiving an identity claim;

determining a target discriminant based on the identity claim and on at least one  
15 target voiceprint model relating to a target individual;

determining a background discriminant based on the identity claim and on at least one background model relating to at least one background individual;

determining a score based on the target discriminant and the background discriminant; and

5           accepting or rejecting the identity claim based on the determined score.

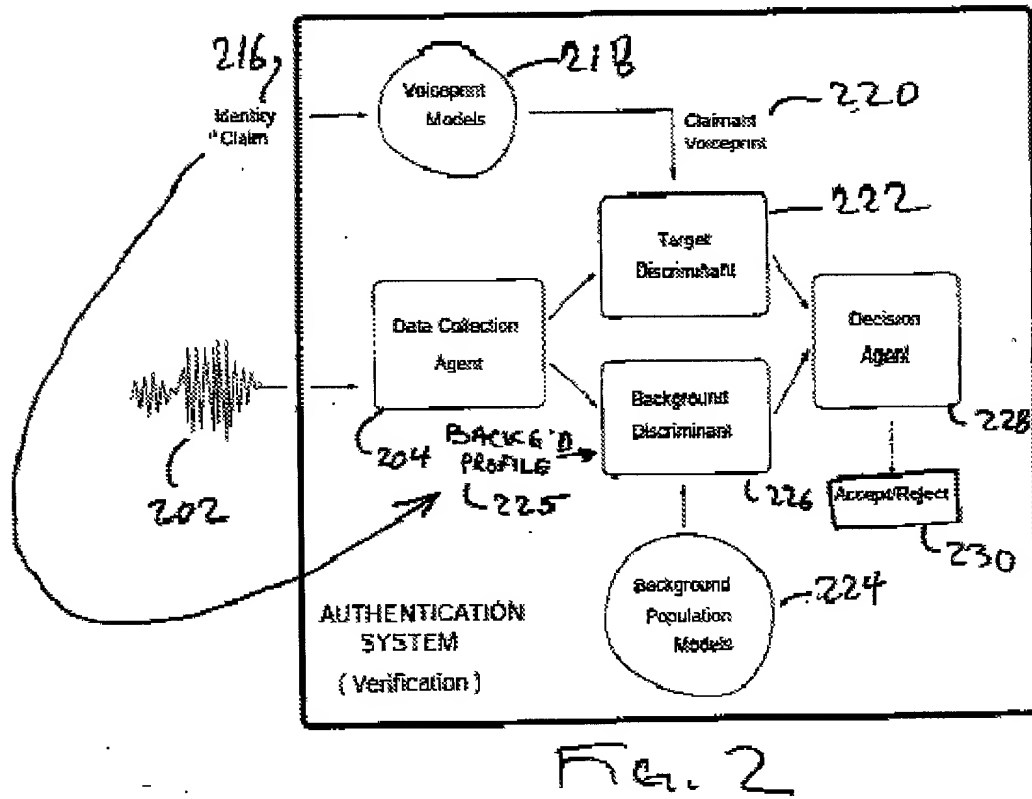
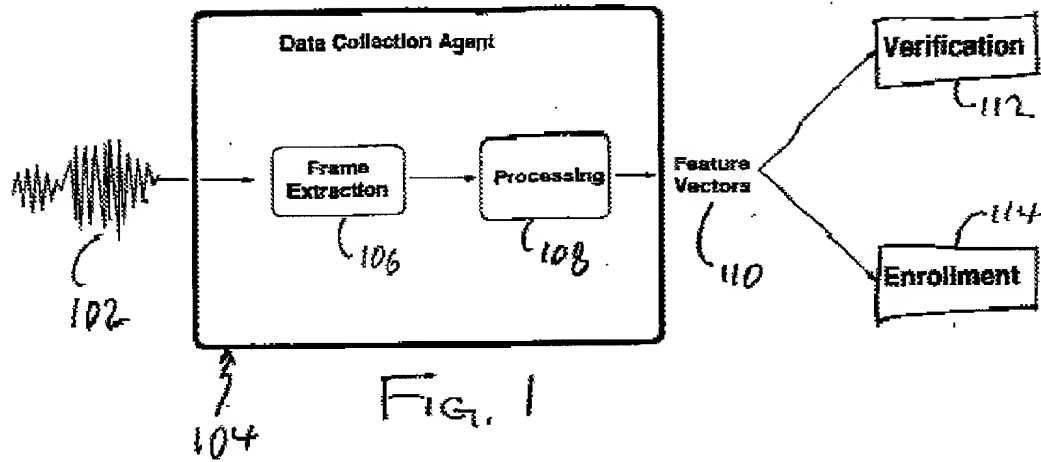
## **WEIGHT BASED BACKGROUND DISCRIMINANT**

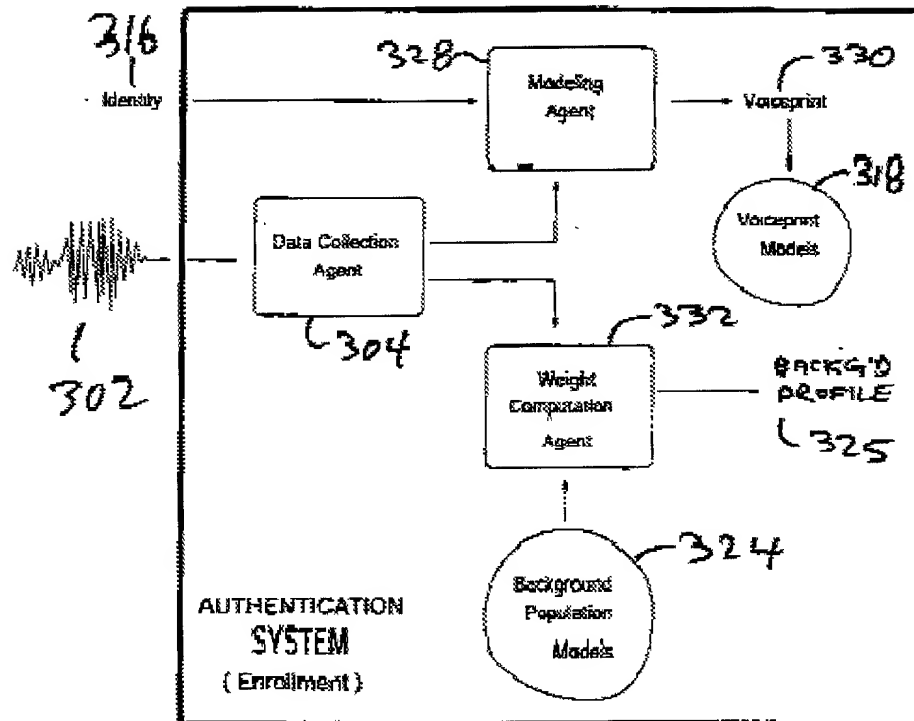
### **FUNCTIONS IN AUTHENTICATION SYSTEMS**

#### **Abstract of the Disclosure**

Methods and apparatus for providing speech-based authentication, including the  
5 determination of a target discriminant based on an identity claim and on at least one target  
voiceprint model relating to a target speaker, of a background discriminant based on the  
identity claim and on at least one background voiceprint model relating to at least one  
background speaker, and of a score based on the target discriminant and the background  
discriminant, which score is used to accept or reject the identity claim.

10





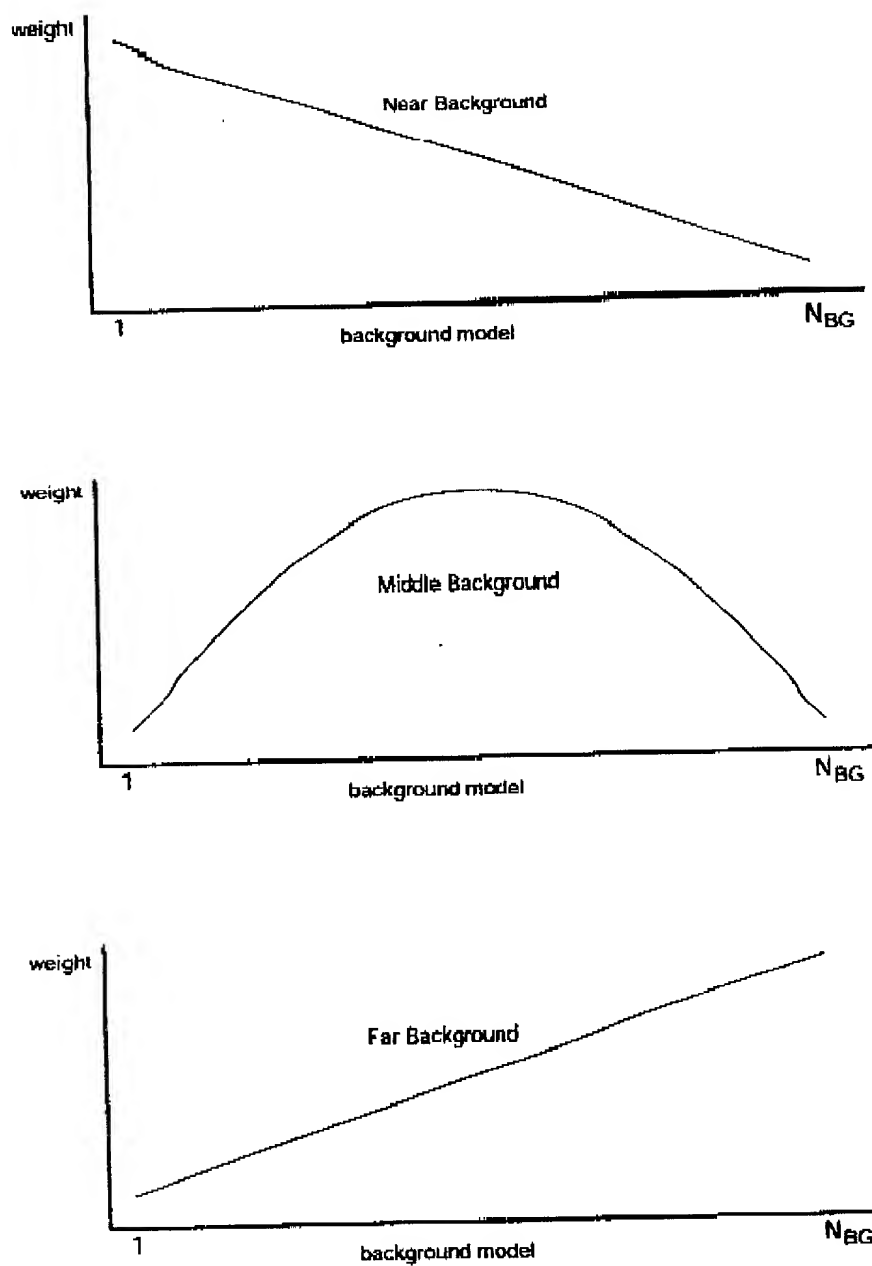


FIG. 4

# DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

## WEIGHT BASED BACKGROUND DISCRIMINANT FUNCTIONS IN AUTHENTICATION SYSTEMS

the specification of which (check one)

\_\_\_\_\_ is attached hereto.

☒ was filed on 13 June 2000 as International Business Machines Docket No. YOR9-2000-0167US1

and was amended on \_\_\_\_\_ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application, having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
_____	_____	_____	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(Number)	(Country)	(Day/Month/Year Filed)		
_____	_____	_____	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(Number)	(Country)	(Day/Month/Year Filed)		
_____	_____	_____	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(Number)	(Country)	(Day/Month/Year Filed)		

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

_____	_____
(Application Number)	(Filing Date)
_____	_____
(Application Number)	(Filing Date)



DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

I hereby claim the benefit under 35 U.S.C. §120 of any United States Application(s), or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States, or PCT International application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose information material to the patentability of this application as defined in 37 CFR §1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

\_\_\_\_\_  
(Application Serial No.)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Status) (patented, pending, abandoned)

\_\_\_\_\_  
(Application Serial No.)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith (list name and registration number).

Manny W. Schecter (Reg. 31,722), Terry J. Ilardi (Reg. 29,936), Christopher A. Hughes (Reg. 26,914), Edward A. Pennington (Reg. 32,588), John E. Hoel (Reg. 26,279), Joseph C. Redmond, Jr. (Reg. 18,753), Paul J. Otterstedt (Reg. 37,411), Douglas W. Cameron (Reg. 31,596), Wayne L. Ellenbogen (Reg. No. 43,602), Stephen C. Kaufman (Reg. 29,551), Daniel P. Morris (Reg. 32,053), Louis J. Percello (Reg. 33,206), Jay P. Sbrollini (Reg. 36,266), Robert M. Trepp (Reg. 25,933), David M. Shofi (Reg. 39,835, and Louis P. Herzberg (Reg. 41,500)

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DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

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Date

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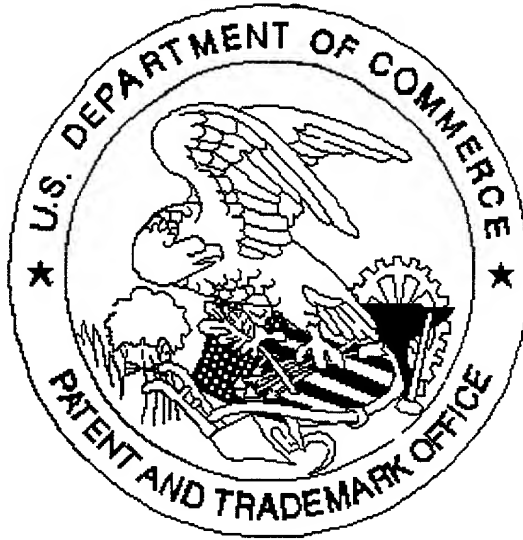
Czech Republic

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*drawings*